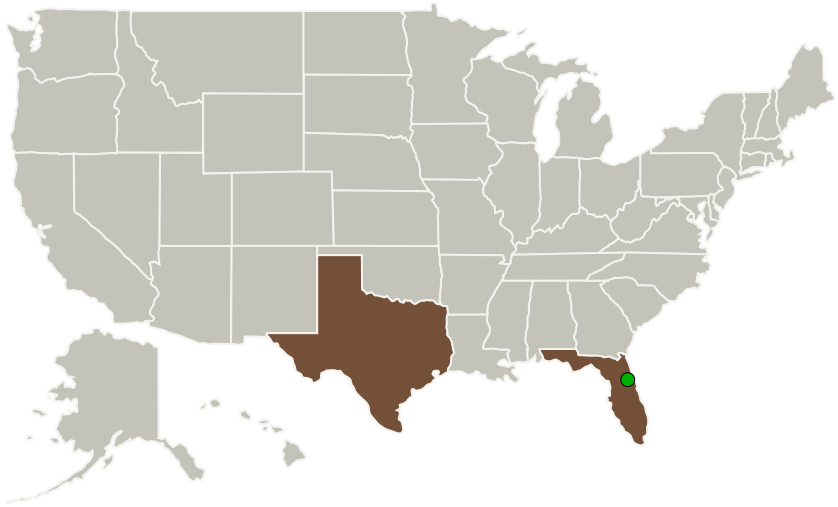
Metal Production Away From Earth, Phase I

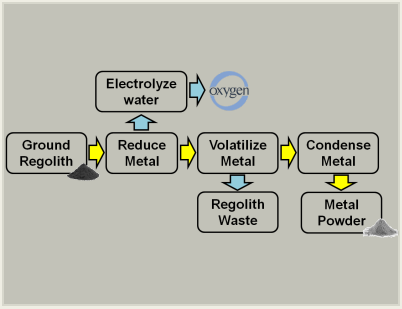
Completed Technology Project (2017 - 2018)

Project Introduction

Long-term occupation of space requires a supply of metal suitable for fabrication of various components and structures. While astronomical objects are rich in the desired metallic elements, these elements are in the form inappropriate for use in Additive Manufacturing processes. Lynntech, in collaboration with University of Texas El Paso, proposes to develop a process to convert material from its native state (typically an oxide dispersed in a silicate matrix) to one suitable for use in Additive Manufacturing methods to allow the direct fabrication of complex parts in space. Proposed process consists of four steps: grinding of the native material for ease of processing, reduction of oxides to zero valent metal, conversion of the metal to a volatile form for separation and recovery, and direct formation of metal powder in a size and purity suitable for use in Additive Manufacturing. Our unique process requires relatively low temperatures, recycles all the reagents (thus there is no need for consumables), and produces oxygen as a byproduct. Phase I effort will demonstrate the reduction, volatilization, and powder formation steps for nickel and iron using regolith simulant as the feedstock. Recovered metal powders will be thoroughly characterized for use in powder-based Additive Manufacturing processes.

Primary U.S. Work Locations and Key Partners





Metal Production away from Earth, Phase I Briefing Chart Image

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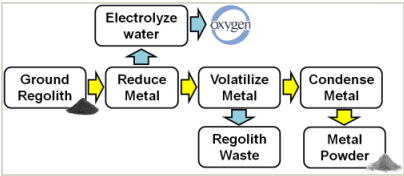
Organizations Performing Work	Role	Type	Location
Lynntech, Inc.	Lead Organization	Industry	College Station, Texas
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida
The University of Texas at El Paso	Supporting Organization	Academia Hispanic Serving Institutions (HSI)	El Paso, Texas

Primary U.S. Work Locations	
Florida	Texas

Images



Briefing Chart Image
Metal Production away from Earth, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/132202)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Lynntech, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

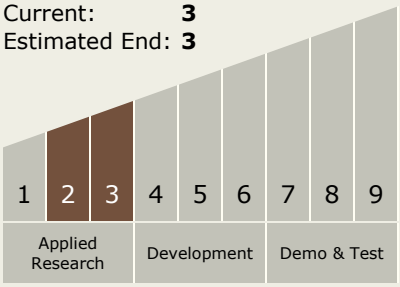
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Sanil John

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System